

PATENT SPECIFICATION



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573,404

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PROVISIONAL SPECIFICATION

Improvements in and connected with the Mounting of Facing Panels, Window and Door Frames and other Fittings

We: BRAITHWAITE & COMPANY ENGINEERS LIMITED, a British Company, of The Moorings, Church Road, Great Bookham, Surrey and FREDERICK ALFRED PARTRIDGE, a British Subject of the Company's address, do hereby declare the nature of this invention to be as follows:—

This invention is particularly concerned with an improved clipping device adapted for use in the mounting of facing panels, window and door frames and like fittings on walls and similar surfaces and which can be employed to particular advantage in the cladding of metal frame skeleton structures.

The clipping device according to the invention comprises a head and limbs mounted thereon in such a way that their free ends can be approached together for insertion between adjacent edge parts of a fitting or fittings to be mounted, these limbs being capable of then springing outwardly so that each clips over the edge part to which it lies adjacent, such edge part being engaged between the head and an outwardly cranked part of the limb. In order to permit of ready insertion between the said edge parts, the free ends of the limbs may incline inwardly towards one another beyond the aforementioned outward cranking so that as the device is pressed home this inclined part of each limb rides easily over the adjacent edge part until the shoulder of the cranking passes behind it whereupon the limb springs outwardly to engage the shoulder behind the edge part and the device becomes automatically locked in place. Each shoulder may be caused, in conjunction with the head, to exercise a gripping action on the edge part by making the head, cranking of the limb, and/or the part of the limb between the head and the cranking, resilient. This provision not only helps to hold the device firmly in place but also, in cases where each edge part lies over an edge part of the backing structure as for instance an edge of a metal plate forming part of a skeleton framework, serves to secure such overlying edge parts together. The device

in these circumstances, is able not only to fill in and to cover over the space between the adjacent edge parts of the fitting or fittings to be mounted for purposes of weather exclusion, but also to anchor these parts to the backing structure. Moreover the device fulfils these functions in a resilient manner so that the fitting or fittings when mounted, are free to float sufficiently to take up any relative movement such as may be caused by expansion and contraction of the interconnected parts due to temperature variations and the materials are consequently relieved from the usual stresses arising when rigid filling and anchoring devices are employed. The head itself may also be made resilient to provide or to enhance the aforementioned outwardly directed spring of the limbs, this in addition to any resilience it may have for the aforementioned purpose of cooperating with the limbs in gripping the edge parts between which the device is inserted. It is desirable also for the device when in position to engage the said edge parts laterally so as thereby to centre it properly in the opening and hold it against transverse displacement. To this end the parts of the limbs between the head and the outward crankings may be shaped to abut against the said edge parts and so to limit the outward spring of the limbs in a symmetrical manner. A clipping device of the character described lends itself to fabrication in resilient sheet metal as an integral unit.

A particular embodiment of the clipping device according to the invention will now be described, for use between the parallel edge parts of adjacent facing panels and/or fittings such as window and door frames which are provided with a corresponding edge part, e.g. a projecting bead corresponding to and lying in the same plane as the edge part of an adjacent panel. A device for this purpose may extend continuously the whole length of the said adjacent edge parts and may be provided with two opposed limbs which may similarly be continuous. The head should be of adequate width to extend

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over the margins of the edge parts and may be of arched or other desired section. If the device is made integrally of sheet metal in the manner already suggested, the limbs can be turned back behind the edges of this head to give the device the general form of a trough or channel. In a preferred construction the sheet metal of the head is convexly curved and each limb is first turned back sharply under the head to lie in contact with the latter over a distance depending on the amount by which the head projects over the outer marginal surface of the panel or the like. The limb is then turned away from the head to extend backwardly therefrom until it reaches an outward cranking to provide the shoulder for engaging behind the panel or the like or behind a metal flange or a series of spaced co-planar metal flanges of the backing structure to which the panel is to be anchored. Beyond the shoulder the limb up to its free edge inclines inwardly towards the other limb. Between the head and the outward cranking, the limb may be outwardly bowed to provide a convexity capable of lateral abutment in a tangential manner against the side edge face of the panel or the like. All the curves are rounded, among other reasons in order to enhance resilience, with the exception of the turning under along the edges of the head where it merges into the limbs. Each limb therefore engages the front of the panel by the side edge of the head directed down towards it at an angle depending on the curvature of the head and also the side edge face of the panel leaving a cavity between these linear contacts which acts as a moisture trap. The shoulder of the outward cranking normally serves purely as an anchor and plays no part in the sealing. It will be understood that this sealing effect of the abutment of the device against the side edge face of the panel or the like is in addition to the centring effect already referred to. In order to mount the device between the spaced edge parts of the panels and of the backing flanges behind them, a tongs-like tool may be used if necessary to hold the clip and compress its limbs towards one another. The resiliency in this particular embodiment to allow of this compression is partly provided by the head and partly by the limbs themselves. The inwardly inclined free edges of the limbs thus approached together are introduced between the edge parts of the panels or the like and the device pressed home, its head being flattened until the limbs spring outwardly as their crankings move behind the edge parts and into locking position.

When pressure on the head is then removed, the inherent resilience of the various parts of the clip causes the latter to centre itself and the limbs to grip their respective adjacent edge parts in an entirely automatic manner, and the clip becomes locked in position.

The following are possible variants of the construction just described and may be made individually or jointly. The head may be fitted with a sheath engaging over the side edges and of any desired finishing material. Alternatively the head may be rigid with the limbs attached thereto and providing in themselves all the required resilience. As a yet further alternative, the gripping action of the limbs may depend wholly or in part on the provision of resilient pads for instance of rubber under the side edges of the head for bearing on the front surface of the panels or the like. Again, instead of relying on the resilience of the parts themselves, the limbs may be spaced by springs acting between them, the limbs being hingedly connected to the head. In another variation, the limbs, instead of being attached directly to the head, may be carried on a stem or web part passing through between the side edges of the space in which the device is mounted so that the limbs do not lie within this space but extend outwardly from one another behind it to provide the necessary clamping parts in conjunction with the head, together preferably with projections to engage the said side edges laterally for centring purposes.

The clip is particularly suitable for use in cladding a skeleton building structure of the kind disclosed in our patent specification No. 560,814, in which standard panel frames adjoin at axes of the structure in such a way as to leave vertical grooves in the face of the latter at these axes. Facing panels and window and door frame fittings may be made slightly narrower than the distance separating the said axes so that their side edges are slightly spaced apart at say a little over half an inch. Up to the aforementioned grooves, may be provided at intervals, anchoring parts of generally triangular or other plan according to the section of the groove. However, the side of each such anchoring part which lies in the face of the skeleton structure is gapped to correspond with the spacing of the side edges of the panels or the like, so as to provide inwardly directed coplanar jaws over and on which the edge parts of the respective panels or the like rest, ready to be clamped thereto when the clips are pressed home.

Dated this 17th day of June, 1943.

For the Applicants:
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COMPLETE SPECIFICATION

Improvements in and connected with Securing Facing Panels, Window and Door Frames and the like in Building Construction

We: BRAITHWAITE & COMPANY ENGINEERS LIMITED, a British Company, of The Moorings, Church Road, Great Bookham, Surrey and FREDERICK ALFRED 5 PARTRIDGE, a British Subject of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 This invention is concerned with an improved clip device in the form of stripping of indefinite length and the use thereof in connection with facing panels, 15 window and door frames and the like in building construction both as a junction member and also for anchoring such parts in or to walls, ceilings and similar surfaces, being particularly valuable in the cladding of skeleton metal structures. 20

The clip device according to the present invention is intended for engaging spaced edge parts of already positioned panels or the like together, if desired, with an 25 anchoring part or parts of a backing structure. The parts to be engaged by the clip whether they consist simply of panels or the like, or whether they also include backing or supporting parts thus used for 30 anchoring the panels or the like are generally hereinafter referred to as "the edge parts."

The device according to the invention belongs to that type of clip comprising a 35 head adapted to remain in front of the edge parts and securing means on the head adapted for insertion into the space between the edge parts to engage behind them after passing through this space, but 40 the invention is not concerned with such devices of this type as are releasable from the front simply by lifting the head i.e. devices which are without latching means to engage behind the said edge parts positively. 45 According to the invention, in clip stripping of the type stated above the securing means is adapted, when the device is in position, to engage laterally against the edge parts and is compressible 50 to permit insertion between the latter of latching means on the securing means,

and when thus compressed is capable of snapping out automatically to engage and lock the latching means behind the edge parts when pushed past them. 55

The securing means may comprise limbs behind the head and outwardly sprung from one another to engage against the edge parts and also to move latching members on the limbs behind the 60 said edge parts. Such limbs may be formed with outward crankings to give shoulders acting as the latching members and beyond these shoulders the limbs may 65 incline towards one another at their free extremities to facilitate insertion between the edge parts.

The securing means may be so formed o.g. by outward bowing or convex curving of the aforesaid limbs, as to improve the 70 lateral abutment thereof against the edge parts and consequently the automatic centring of the device between such parts and also to produce additional weather sealing in conjunction therewith. 75

Preferably the head is made resilient and capable of deformation in order to permit the latching means to pass through the space between the edge parts into position for engagement and when 80 the deforming force is released, of seeking to revert to its former shape so as to draw the latching means towards it and to clamp the edge parts between the latching means and the head. Thus the head may 85 be of resilient arched section with its edges adapted to bear on the edge parts at an angle. The device in this form is to be distinguished from certain prior proposals of clip comprising positive latching 90 means in conjunction with a resilient head, in that such proposed devices are not suitable for production in the form of stripping of indefinite length in which, as according to the present invention, the 95 securing means, besides carrying positive latching means, is also adapted to abut laterally against the edge parts between which such stripping is mounted and thus to fill (in the sense of extending across the 100 whole width of) the space between such edge parts. Movement of latching mem-

bers lengthwise of the space, instead of across it, as in one proposal is clearly unsuitable for stripping having these characteristics. In general it may be said that if the latching members are to be capable of extending behind the edge members to a distance comparable with the extension of the head in front of such members as is desirable for sake of security and at the same time the securing means is to be adapted to fill a particular spacing between the edge parts and yet be compressible in order to pass the latching members between the said edge parts as herein prescribed, then the combined extensions of the latching members must not exceed the width of such spacing. The device of the present invention is therefore distinguishable from prior proposals of resiliently headed clip wherein the attachment depends largely on outward swinging of latching members from the lower ends of relatively closely adjacent limbs on which they are mounted, after such members have been passed behind the edge parts, since such a manner of operation is inconsistent with ability to fill the space occupied by the device.

According to an alternative form of the invention the head is rigid and the effect of resiliency required to pass the latching members behind the edge parts is obtained by using resilient pads beneath it. Such pads may also similarly be used beneath the resilient head if additional springiness is wanted.

The device may conveniently be made in the form of an integral unit of resilient sheet material such as metal. Alternatively, securing limbs may be formed separately from the head and attached thereto. After the device has been pressed home sufficiently to enable the limb shoulders or the like to snap out behind the engaged edge parts, the device will lift or tend to lift somewhat if resiliency is provided in either of the two ways already mentioned between the device and the front of the panels or the like and this will result in clamping of such edge parts. Resiliency may however also be provided in the engagement between the shoulders and the back of the edge parts.

The device lends itself to manufacture in the form of stripping of constant section for use along the length of the gap between the spaced side edges of adjacent facing panels or the like. Alternatively the head only may be a continuous strip with securing means provided at intervals along its length.

The head of the device must remain at all times in front of the edge parts, and extend far enough in each side of the gap

to ensure that it does not pass into and through the gap in the process of insertion of the device. The chosen dimensions of the device must of course be appropriate to the thickness of the edge parts and the width of the gap between them, but if the head is sufficiently resilient, the device will accommodate itself to a considerable range of thicknesses. Likewise the formation of weather seals and the self-centring effects will depend on the relation between the dimensions of the device and the width of the gap, but sufficient resiliency of the securing means will here again permit of the device accommodating itself to some variation in such width.

Use of a clip device as described makes possible a building construction which is also a feature of the invention, comprising a backing structure formed with anchor parts against which lie edge parts of panels or the like, the clip device being inserted between the panels to join the spaced edges thereof and to attach them to the backing structure. The latter may take the form of vertically arranged panel frames having side edge members which are grouped about axes of the structure, the panels being applied to the panel frames and spaced apart opposite the said axes.

A further feature of the invention lies in the use in conjunction with a clip device as already described of anchoring means for the panels and the like comprising cleats for attachment to a building structure, such cleats being formed with pairs of inwardly directed coplanar jaws the ends of which jaws are spaced apart, and are engaged by the clip device.

A clip device of the kind herein set forth, when mounted between the edge parts of panels or the like whether or not these overlie anchor parts of the backing structure, serves to interconnect them in a non-rigid manner leaving them free to float sufficiently to take up such relative movement as may for instance be caused by expansion and contraction due to temperature variations and the materials are consequently relieved from stresses which might otherwise arise. Although the principal application of the present invention will probably be in connection with facing panels, it is also applicable to window and door frames and such like building fittings provided these have edge parts suitable for engagement by the clip devices in the manner described e.g. projecting flanging or beading lying in the plane of adjacent panels and such fittings are intended to be covered by the expressions "panels" and "panels and the like" and to be included in the term "edge parts."

Selected embodiments of the invention will now be described by way of example with reference to the accompanying drawings wherein:—Figures 1 to 4 show one form of clip stripping, of which Figure 1 is a sectional view, Figure 2 being a similar view showing the stripping with its limbs in process of being inserted between edge parts of two panels and of a backing cleat, Figure 3 being another similar view after the head of the stripping has been pressed home, and the limbs engaged, whilst Figure 4 is a perspective view corresponding to Figure 3 showing parts broken away as required to enable their relative disposition to be seen; Figures 5 to 7 show a modified form of stripping in views similar to those of Figs. 1 to 3; Figures 8 and 9 are sectional views of two further modifications shown in mounted position only i.e. corresponding to Figs. 3 and 7; Figure 10 is a sectional view illustrating further possible features of detail whilst Figure 11 is an inverted perspective view of a yet further modified form of device having a continuous head strip with limb parts secured thereto possibly only at intervals along its length in the neighbourhood of anchoring cleats.

Considering firstly the embodiment shown in Figures 1 to 4, it should first be observed that the backing structure shown in Figures 2 and 4 is part of a skeleton building according to our patent Specification No. 560,814, A being on axis of such a structure and 10, 11, being the near side edge members of two panel frames grouped in alignment about such axis and 12 being one of the junction members which are provided at intervals up to the axis within the V-channels to which the tapering formation of the side edge members give rise. These junction members instead of being mere angle pieces for bolting to the side edge members as at 13, may be adapted to act also as cleats for engagement by the clip stripping according to the present invention. For this purpose the free ends of the limbs of the junction member are turned in towards one another in the plane of the marginal edging 14 of the panel frames to form edge jaws 15 spaced apart to substantially the same extent as the gap proposed between the edge parts of facing panels 16 and 17 with which the skeleton structure is to be clad. These panels lie against the edging 14 and the cleat jaws 15 which are as already indicated coplanar. In facing a skeleton structure of this kind the panels 16 and 17 are temporarily held in position spaced apart at approximately the correct distance whilst the clip stripping is inserted between them and pressed home. If

panel 16 is supposed already clipped up its left hand side edge, then its right hand side edge will be sufficiently located. All that is needed for locating panel 17, will be a removable block inserted between the jaws of cleats at the next axis to serve as a temporary abutment for the right hand side edge of panel 17 whilst the latter is also held up against the supporting surfaces of the skeleton backing.

The clip stripping shown in Figures 1 to 4 is of integral sheet metal construction of which both the head 18 and the two opposed limbs 19 extend continuously throughout its length i.e. the section is constant. A sufficient length of such stripping can be cut off to extend the full length of the adjacent panel or like edge parts. The head 18 should be wide enough to extend over the margins of these edge parts with sufficient overlap and is of arched section. The limbs 19 are turned back behind the edges of this head to give the device the general form of an inverted trough or channel. In the construction shown, the metal of each limb is first turned sharply under the head to lie in contact with the latter over a distance slightly more than that of the aforementioned overlap. In this way the double-thickness edges of the head act as resilient lips 20 engaging the fronts of the panels at an angle depending on the curvature of the head. After thus approaching one another in contact with the under surface of the head, the limbs are bent back. The length of the limb portions 21 extending to the outwardly cranked shoulders 22 which are adapted to engage behind the edge parts to be joined, depends on the width or combined width of the edge parts for which the device is intended and also the degree of resiliency in the lips 20 and in the shoulders 22 towards one another. Beyond the shoulders 22 the limbs incline over parts 23 inwardly towards one another, to terminate in beadings 24.

In order to mount the device between the spaced panel edge parts, the limbs are approached towards one another until the free beaded edges 24 can be inserted. On pressure being then applied on head 18, the inclined parts 23 first ride over the spaced edges of the panels, then the shoulders move across the side faces thereof and past the ends of cleat jaws 15, whereupon the limbs spring outwardly into locking position. During this sequence the major part of the hinging of the limbs takes place about lines 25 where the limbs leave the underside of the head. It is also clear that the width of shoulder crankings 22 must not be too great to permit of the necessary approach of the limbs

towards one another in the Figure 2 position. This means that each cranking must be not more than a little under half the width of the gap between the panel side edges. As the device is pressed home, pressure on the central part of the head 18 leads to spreading apart of the lips 20 as indicated by the arrows in Figure 2 so that the lips to some extent ride out over the front surface of the panels which their angular contact therewith enables them to do. When the device becomes locked and pressure on the head is then removed, the device will be caused to lift or will tend to lift against any resiliency there may exist in this direction in the shoulder crankings 22 or other part of the limbs. A state of balance will therefore be set up as a result of which the panel and like edge parts are gripped or clamped symmetrically whilst the outward spring of the limbs causes the device to centre itself in the gap, all in an entirely automatic manner.

Figures 5 to 7 show a modification better suited for the outer cladding of building structures. The main difference to notice, other than the greater depth between the head and shoulders 22 on account of the thicker panels, is the provision of convexity 21a in the intervening part 21 of each limb for abutment in a tangential manner against the adjacent panel edge face, so that the space between such abutment and the associated lip 20, forms a double weather seal and moisture trap 26 around the panel edge. Certain consequential alterations which have been found desirable in the relative spacing and dimensions of the parts can be sufficiently gathered by comparison of the drawings.

In the constructions of Figures 8 and 9, the head 28 is substantially rigid and the limbs are of sheet metal attached thereto as by riveting. In these cases, pads 29 of resilient material such as rubber preferably in the form of continuous strip must be provided under the side edge lips 30 in order to produce a clamping effect on the side edge parts, these being optional when the lips on the head are themselves sufficiently resilient. In both these rigid headed modifications, the limbs are shown with convexities to form weather seals as already described although this is not of course essential. In Figure 8 the limbs are shown as of sheet metal independently attached to the head, whereas in Figure 9 the head is shown with a stem or web part 31 to which an integral sheet metal inverted channel 32 is attached to form the two limbs as shown.

The modifications shown in Figure 10 in which the stripping is fundamentally of

the same section as in Figure 1, are firstly the provision of a sheath 33 fitted over the head 18 and engaging around lips 20 to give any required decorative finish. This Figure also shows the use of spring means in the form of a resilient block 34 which may be of spongy rubber at intervals between the limbs to provide or assist in providing the required outward spring between them. In this connection it should be observed that in the constructions previously described in which inherent resilience of the material of the limbs and/or head is relied on for this purpose, the stripping may be provided with the limbs initially spread out away from one another to a greater distance than when the stripping is mounted in place instead of to the same distance as shown in Figures 1 and 5.

In the Figure 11 arrangement the head 35 takes the form of a continuous arched part which is preferably resilient and provided with beaded edges 36 corresponding to lips 20 of Figure 1. The anchoring limbs form part of a separate inverted channel 37 similar to channel 32 of Figure 9 but shown in this instance without convexities like those at 21a in Figure 5. The base of the channel 37 may be attached to the head by rivets 38 one of which appears in the drawing.

Figure 11 is of special significance as illustrating the fact that the limbs need not necessarily be continuous along the stripping; short members such as 37 may be provided along it at intervals corresponding to the spacing between the anchoring cleats 12.

As applied to the aforementioned skeleton building construction according to our patent Specification No. 560,814, the facing panels and window and door frame fittings may be made slightly narrower than the distance separating the axes i.e. than the panel frames of the skeleton structure, so as to leave gaps of say a little over half an inch between adjacent edges of such facing panels and fittings. The triangular cleats 12 will then have the inwardly directed ends of their jaws 15 separated at the same distance. If the skeleton structure is such that other than V-section surface grooves are formed up it at the axes then the shape of cleats 12 can be altered to correspond.

In mounting the clip stripping between the spaced edge parts of the panels and of the cleat jaws, a tongs-like tool may be used if necessary to compress the limbs sufficiently towards one another to enable them to be inserted into the gap.

Having now particularly described and ascertained the nature of our said inven-

tion and in what manner the same is to be performed, we declare that what we claim is:—

1. A clip device of the type set forth in 5 the form of stripping of indefinite length wherein the securing means is adapted, when the device is in position, to engage laterally against the edge parts and is compressible to permit insertion between 10 the latter of latching means on the securing means, and when thus compressed is capable of snapping out automatically to engage and lock the latching means behind the edge parts when pushed past 15 them.
2. A clip device according to Claim 1 wherein the securing means comprises limbs behind the head and outwardly sprung from one another to engage 20 against the edge parts and also to move latching members on the limbs behind the said edge parts.
3. A clip device according to Claim 2 wherein the limbs are formed with outward crankings to give shoulders acting as the latching members.
4. A clip device according to Claim 3 wherein beyond the shoulders, the limbs incline towards one another at their free 30 extremities to facilitate insertion between the edge parts.
5. A clip device according to any preceding claim wherein the securing means is so formed e.g. by outward bowing or 35 convex curving of the limbs composing it, as to improve the lateral abutment thereof against the edge parts.
6. A clip device according to any preceding claim wherein the head is made 40 resilient to permit the latching means to pass through the space between the edge parts into position for engagement and when the deforming force is released of seeking to revert to its former shape so as 45 to draw the latching means towards it and to clamp the edge parts between the latching means and the head.
7. A clip device according to Claim 6 wherein the head is of resilient arched section with its edges adapted to bear on 50 the edge parts at an angle.
8. A clip device according to any of Claims 1 to 5 wherein the head is made rigid.
9. A clip device according to any of 55 Claims 1 to 7 in the form of an integral unit of resilient sheet material.
10. A clip device according to Claim 9 formed by turning the sheet material 60 sharply under the head to lie along the under surface of the latter before being bent back therefrom to provide securing limbs, whereby double thickness edges are produced on the head adapted to act as resilient lips for bearing on top of the 65 spaced edge parts.
11. A clip device according to any of Claims 1 to 5 and 8 wherein the limbs are formed separately from the head and attached thereto. 70
12. A clip device according to any preceding claim wherein the stripping is of constant section.
13. A clip device according to any of 75 claims 1 to 11 comprising a continuous strip head with securing means at intervals along its length.
14. A clip device substantially as described with reference to Figs. 1 to 4, to 80 Figs. 5 to 7, or to any of Figs. 8 to 11 of the accompanying drawings.
15. A building or like construction comprising a backing structure formed with anchor parts against which lie edge 85 parts of facing panels or the like and clip stripping according to any preceding claim inserted between the panels to join the spaced edges thereof and to attach them to the backing structure.
16. A building or like construction 90 according to Claim 15 wherein the backing structure is composed of vertically arranged panel frames having side edge members grouped about axes of the structure, the facing panels or the like being 95 applied to the said panel frames and spaced apart opposite the said axes.
17. A building or like construction according to either of Claims 15 or 16 wherein the backing structure is formed 100 with vertical grooves containing cleat members to act as anchor parts.
18. A building or like construction according to Claim 15 wherein the backing structure comprises panel frames and 105 cleats which serve both as junction members between the said frames and also to anchor the clip stripping.
19. A building or like construction according to Claim 15 comprising panel 110 frames, cleats, and facing panels or the like assembled substantially as described with reference to Figs. 1 to 4 of the accompanying drawings.
20. A building or like construction 115 according to any of Claims 15 to 18 comprising resilient pads between the head of the clip stripping and the edge parts of the panels or the like.
21. A building panel or like anchoring 120 means comprising cleats for attachment to a building structure, such cleats being provided with pairs of inwardly directed coplanar jaws the ends of which jaws are spaced apart, and clip stripping according 125 to any of Claims 1 to 14 adapted to engage with the said jaws.
22. A building panel or like anchoring

means according to Claim 21 wherein the cleats are substantially as described with reference to Figs. 1 to 4 of the accompanying drawings.

Dated this 17th day of June, 1944.

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The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies,
price 1s. 0d. each (inland) 1s. 1d. (abroad) may be obtained.

FIG. 1

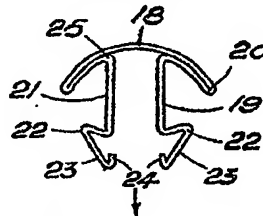


FIG. 2

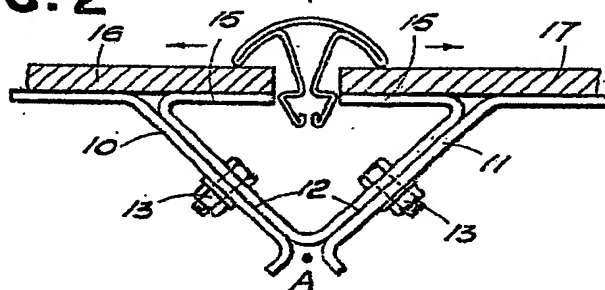


FIG. 3

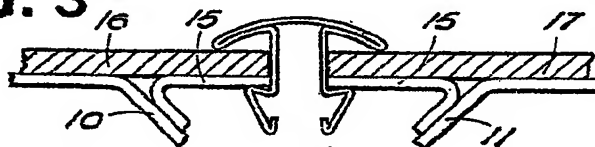
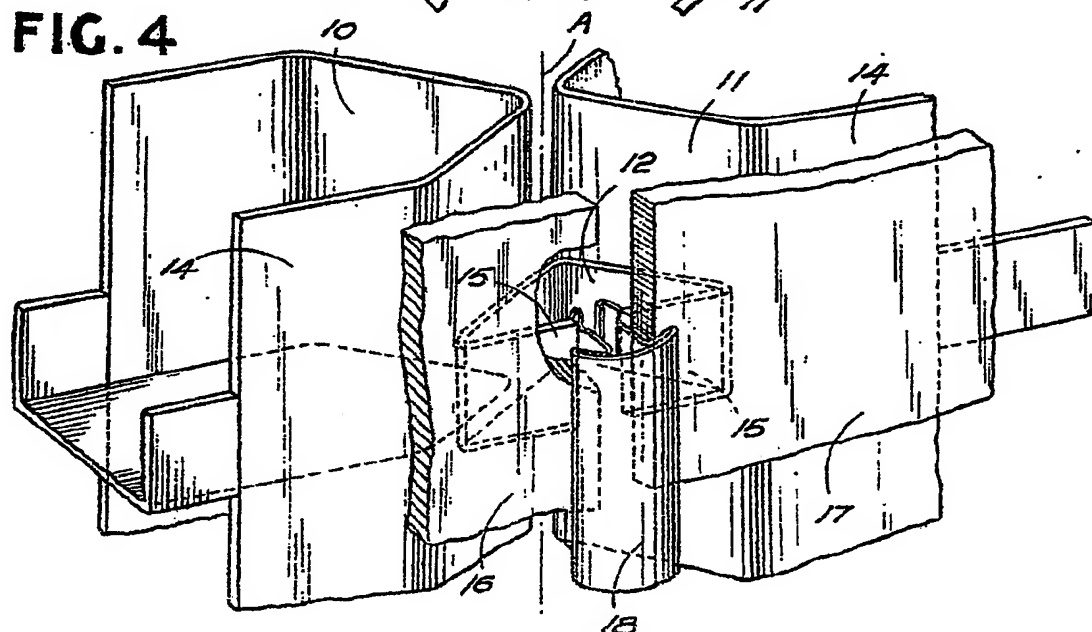


FIG. 4



[This Drawing is a reproduction of the Original on a reduced scale.]

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FIG. 5

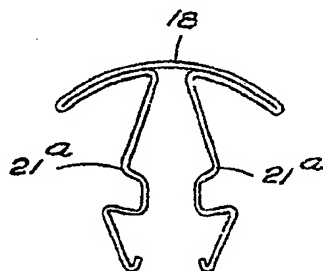


FIG. 6

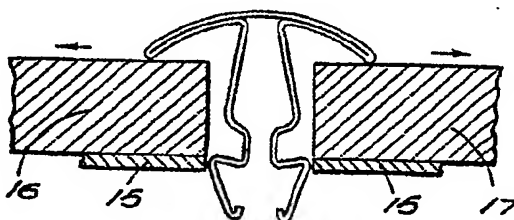


FIG. 7

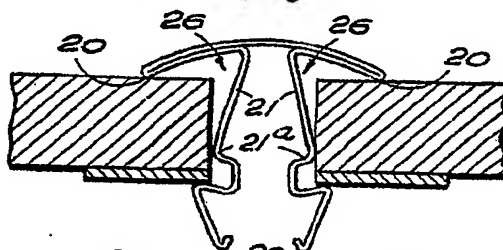


FIG. 8

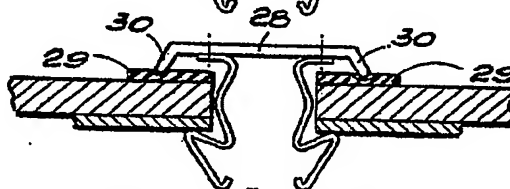


FIG. 9

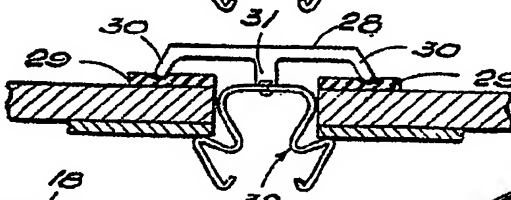


FIG. 10

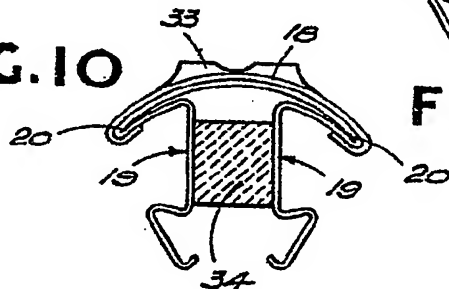
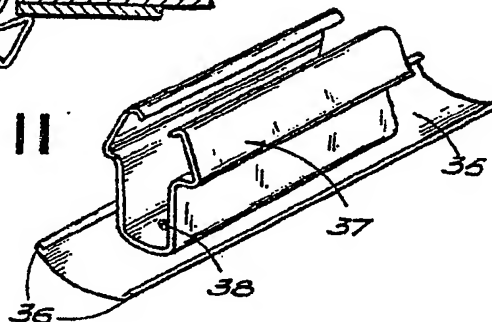


FIG. 11



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SHEET 1

FIG. 1

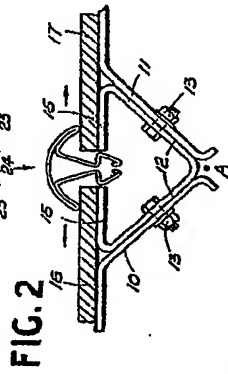
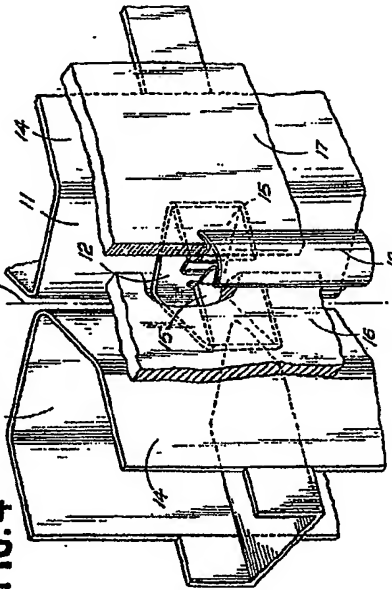


FIG. 2

FIG. 3



FIG. 4



SHEET 2

2 SHEETS

FIG. 5

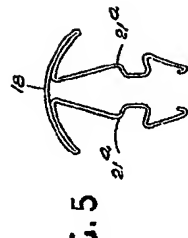


FIG. 6

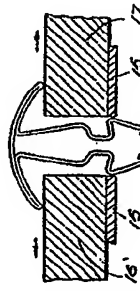


FIG. 7

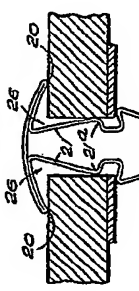


FIG. 8

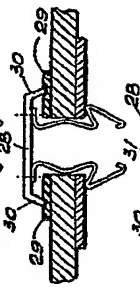


FIG. 9

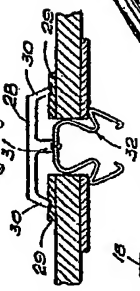


FIG. 10

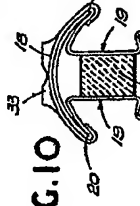
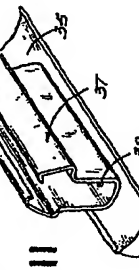


FIG. 11



[This Drawing is a reproduction of the Original on a reduced scale.]